Predictive Profiling of Crisis-Proof Individuals: Current Behaviours

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The world has recently experienced the COVID-19 pandemic, a crisis with ongoing impacts. However, this is neither the first nor the last one of its kind. Every individual reacts to these situations differently with a variety of different effects. Hence, verifying the possibility of profiling individuals based on their personality and psychological predictors could be a useful step and the tool developed using such a method can have a great potential to implement important precautionary measures for the future. In our previous study (Yilmaz & Karanth Ramadeva, 2023), a large cross-cultural and multidimensional data set was collected (N=209). In our analyses, we used the current behaviour scale from the dataset to compute the factor loadings using Confirmatory Multidimensional Item Response Theory (IRT) models. The current behaviours of people during the pandemic were loaded into three higher dimensions which are - social distancing, taking health precautions, and personal hygiene. Further, we explored the individual distributions of current behaviours' dimensions and observed a normal distribution for each dimension. Therefore, a simple approach as such a median split is applicable to characterize the individuals as crisis-proof or not. As a future direction to this project, we aim to apply supervised machine learning with predictors such as personality traits, risk perception, and emotional regulation to understand the significant features which are necessary to predict distinct profiles of individuals, in the context of crisis-proofing.

COVID-19, current behaviours, item response theory, crisis-proof

1 Introduction

The history of humankind witnessed many life-threatening situations that have impacted people worldwide, such as the Spanish Flu (1918-19), the Big Depression (1930s), WW2 (1939-45), Chernobyl (1986), 9/11 (2001), SARS (2002-04), Fukushima (2011), MERS (2012-2018), and Ebola (Jeronimus, 2020). These disastrous events caused stress, social isolation, ambiguity, and economic challenges for individuals and society. The *COVID*-19 pandemic is the recent example of a crisis (still ongoing) announced by the World Health Organization in 2020, marking the onset of the COVID-19 pandemic, which continues to exert a lasting influence on the mental well-being of people worldwide (Rajkumar, 2020) in many other forms such as - long-covid, which is estimated to affect 65 million individuals worldwide (Davis et al., 2023).

These crises call for governments and authorities to establish strict restrictions from global lockdowns to border closures, encouraging citizens to adopt preventative measures and take health precautions including practices like maintaining physical distance, adhering to hygiene protocols, and engaging in self-isolation, with the aim to mitigate the transmission of coronavirus disease 2019 (COVID-19) (West et al., 2020). However, complying with the recommended rules largely depends on citizen's individual traits (Kim et al., 2022). Therefore, adopting a person-centred approach by profiling shared characteristics within a population holds valuable insight into developing preventive precautions (Kleitman et al, 2021).

In line with a person-centred approach suggested by Kleitman et al (2021), our study aimed to use the current behaviours questionnaire (Francis and McNabb, 2020) as indicative of how

people are engaged with pandemic-related behaviours. For this purpose, we employed explanatory and confirmatory IRT models to compute distinct dimensions of current behaviours. Further, by inspecting the distributions of factor scores among participants, we used a simple approach to characterize individuals as 'crisis-proof' or not with a median split. This will be insightful for further studies to determine the importance of personality and psychological predictors such as personality traits and risk perception.

2 Methods

A large and multidimensional data (N = 209) has been collected in our previous study (Yilmaz & Karanth Ramadeva, 2023) during June to September 2022, with the ethical approval from the Research Impact Assessment and Ethics Committee of the Carl von Ossietzky Universität Oldenburg. The socio-demographic characteristics (gender, age, nationality, and country of living) of participants are given in Table 1.

The current behaviour scale contains 11 questions (Francis and McNabb, 2020), which include questions regarding the behaviour related to personal hygiene, social distancing etc., The participants would answer on a 5-point Likert scale (1 = I never do this, 5 = I always do this) Example Question:

"I am avoiding places where many people gather".

In this study, we used exploratory and confirmatory multidimensional Item Response Theory (IRT) models for current behaviours, to understand the higher dimension characteristic hidden in the sample behaviour during COVID-19. The analyses were done using *mirt* package (v1.33.2; Chalmers, 2012) on the R Software for Statistical Computing (v4.2.0; R Core Team 2022). Based on the likelihood ratio test, a model comparison was verified.

n = 209		
Age	$\bar{x}$	σ
	27	7.45
Gender	**F**	**%**
Female	111	53.11%
Male	92	44.01%
Others	6	2.87%
Nationality: n = 26		
German	78	37.32%
Indian	85	40.67%
Others	46	22.01%
Country of Living: n = 21		
German	99	47.37%
Indian	63	30.14%
Others	47	22.49%

Table 1: Sociodemographic characteristics of the sample

3 Results

The categorical principal component analysis with the *princal* function of the *R/Gifi* library (v0.4.0; Mair, 2022) was used to verify the unidimensionality of current behaviours.

As a result, the multidimensionality of data was observed (Figure 1a). The scree plot is used to demonstrate what number of factors the 3 factors model was found to best fitting the data, based on the Kaiser Criterion (eigenvalue = 1) (Figure 1b).

The items having factor loadings highest among all factors and the content-wise similarity are considered as the criteria to define which items correspond to which latent variables. Therefore, the three factors were defined as social distancing (sd), taking health precautions (thp), and personal hygiene (ph).

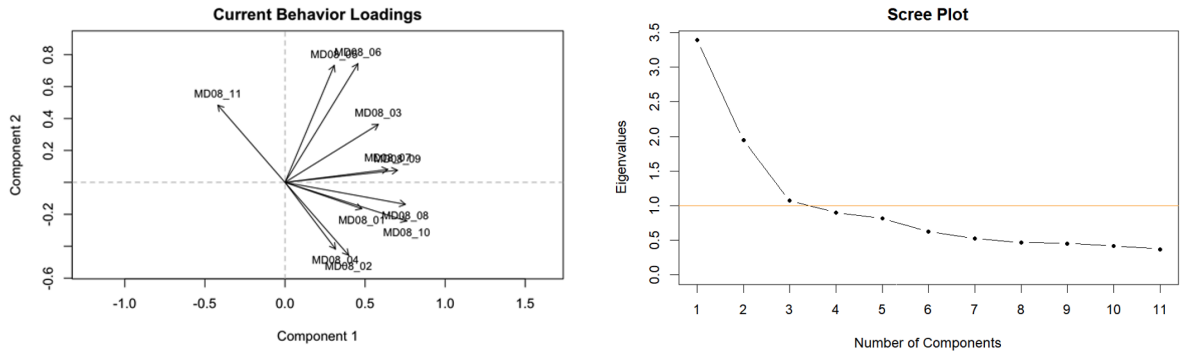

Figure 1: (left) Princals loadings explaining the violation of unidimensionality of items where the arrows point in different directions indicating their non-homogeneous nature. (right) Scree plot demonstrating the number of factors to retain. The yellow line indicates the Kaiser criterion i.e. eigenvalue of 1.

Confirmatory multidimensional IRT model

No.	Item	sd	thp	ph
8	I am avoiding places where many people gather	0.88	0.04	-0.08
10	I am staying at least 2m away from people when outside of my home	0.78	-0.12	0.24
7	I am avoiding close contact with anyone who is showing symptoms.	0.52	0.21	-0.06
9	I am self-isolating if showing symptoms or if living with someone showing symptoms	0.42	0.40	0.19
4	I am traveling abroad during the pandemic	0.11	0.00	0.36
5	I am covering my mouth when I cough	-0.16	0.90	0.04
6	I am avoiding close contact with anyone who is showing symptoms	0.37	0.67	-0.07
3	I am staying at home when I am sick or when I have a cold	0.22	0.49	0.18
2	I am touching my eyes, nose, and mouth with unwashed hands.	-0.02	0.03	0.74
1	I am washing my hands for 20 seconds	0.11	0.10	0.43

Table 2: Factor Analysis of Current Behaviours by IRT Model

The confirmatory model demonstrated a good fit to the data, and its adequacy was verified using the M2-type statistic (Maydeu-Olivares & Joe, 2006), revealing a significant p-value ($p<0.05$). The RMSEA, with a 95% confidence interval, was calculated as 0.24, while TLI and CFI were found to be 0.47 and 0.9, respectively. These statistical indicators collectively support

the robustness of the confirmatory model and provide a foundation for further analysis of individual differences in the context of distinct profiles.

Distributions of Current Behaviour Dimensions Scores

The scores for social distancing, taking health precautions, and personal hygiene dimensions yielded a normal distribution, indicating the applicability of characterizing individuals with a median split (Figure 2).

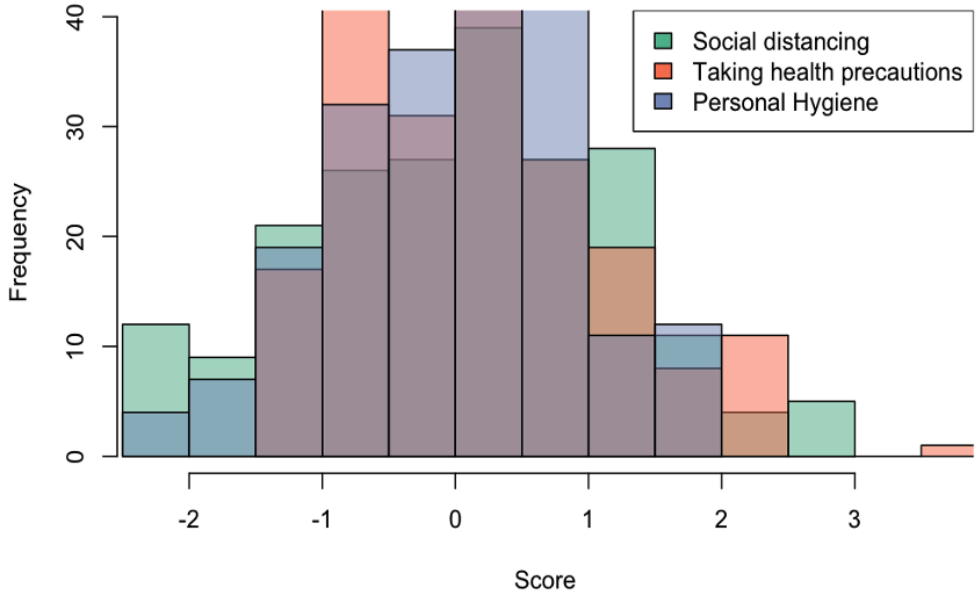

Figure 2: Overlapped histograms of current behavior dimensions: social distancing(green), taking health precautious(orange) and personal hygiene (purple).

4 Discussion

In this study, we performed a second phase of analyses on the multi-dimensional data collected by Yilmaz and Karanth Ramadeva (2023). This phase of analyses focused on the current behaviour during the COVID-19 pandemic. We performed confirmatory IRT models to obtain dimensions of current behaviours and profile individuals based on obtained scores with a median split. To understand the crisis profiling and individual differences, current behaviour and the analyzed dimension of it, serves as a key factor. Based on these results, further analyses on crisis profiling must be conducted along with other scales in the data set such as - Adapted Moralisation of Everyday Life Scale (MELS) computed in the first phase. In perspective, such profiles can help target individuals for generalized crisis-intervention training and develop effective crisis-communication strategies.

5 Acknowledgement

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